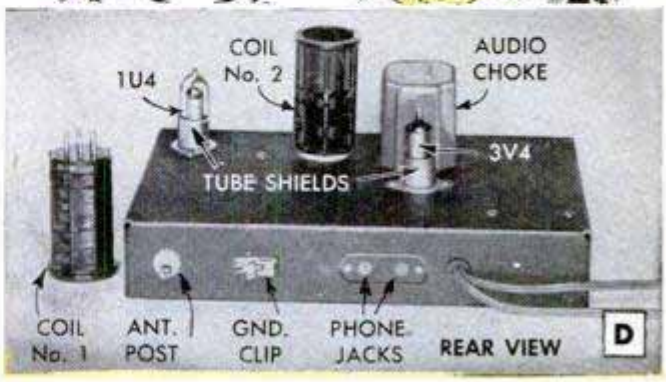
SET FOR EXPERIMENTERS

the standard broadcast band; coil No. 2 tunes the rest of the broadcast band and extends up to about 2000 kilocycles. The set is built up on a standard 2 x 7 x 11-in. black crackle-finished chassis base. All base-drilling details are shown in Fig. 4. Mount the various parts in the positions indicated in the various photos and pictorial wiring diagram, Fig. 2. When mounting the audio choke on top of the base, make sure that the terminals are centered in the chassis holes and clear the chassis. This is also important in respect to the terminals on the phone-jack strip mounted on the rear of the chassis base. Make certain that the holes in the chassis are plenty large at the points where the connecting terminals go through. The audio choke can be any 500-hy. type such as the UTC S-23 or similar unit. Any standard 3-1 ratio audio transformer with primary and secondary.



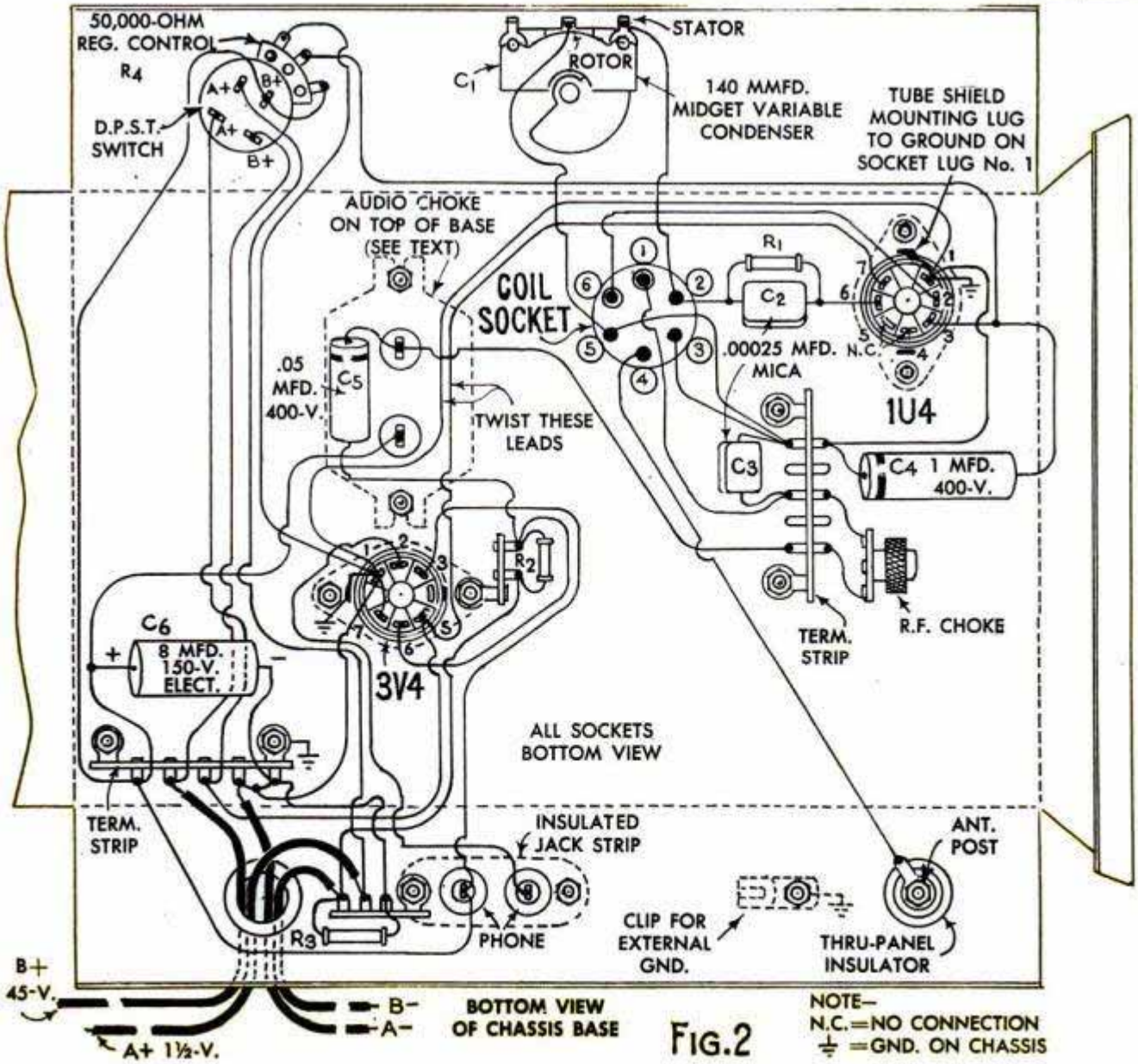
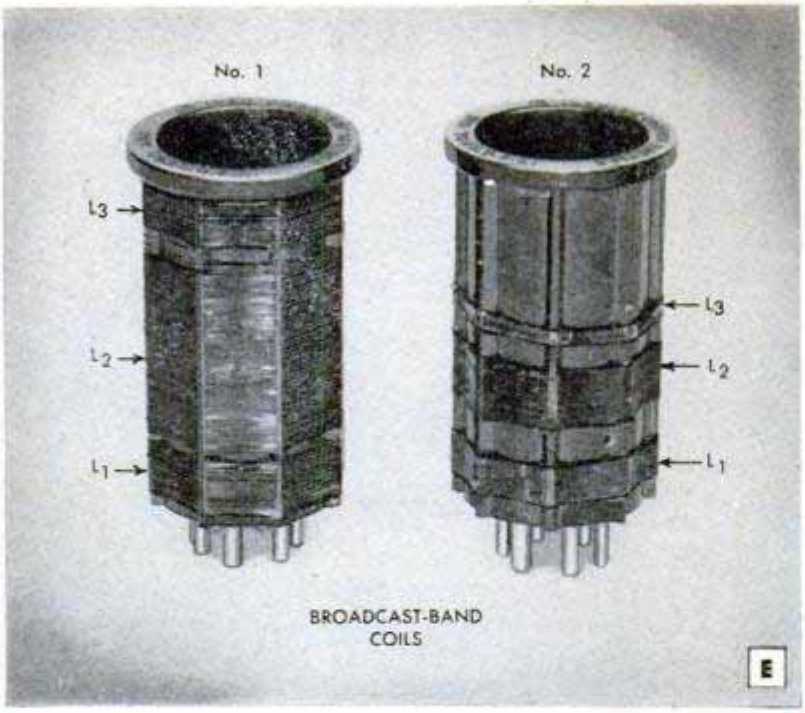


FIG. 2



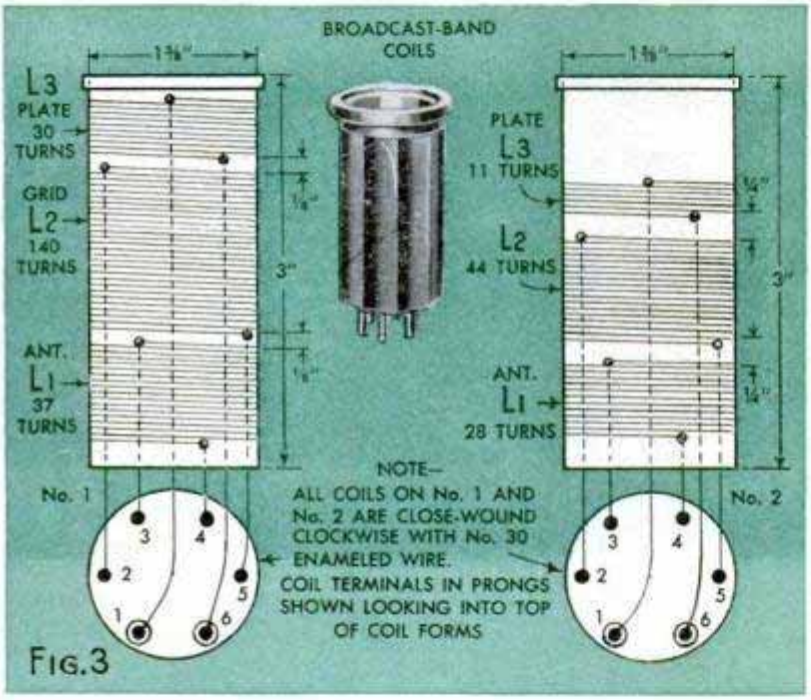


FIG. 3

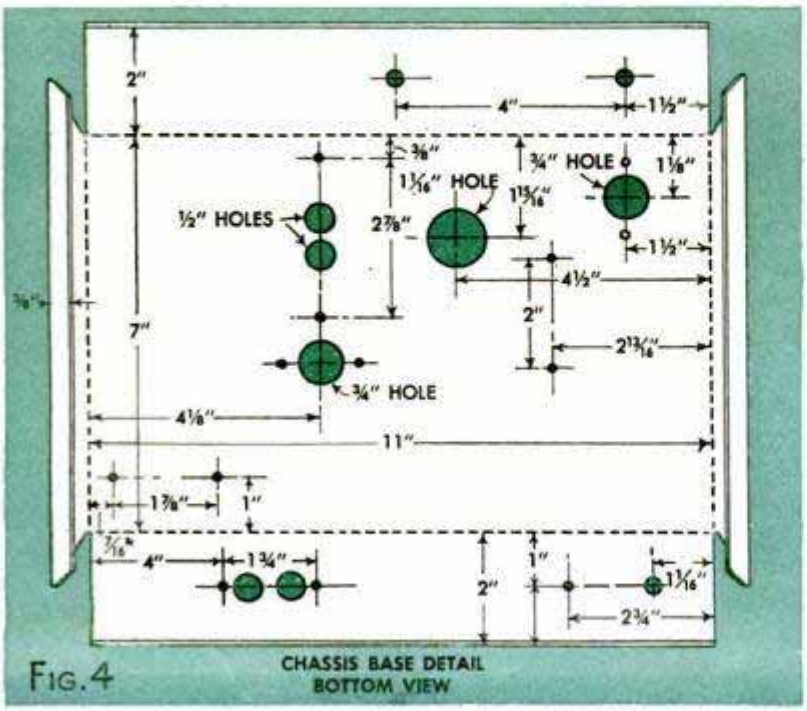


FIG. 4

windings connected in series may be used instead.

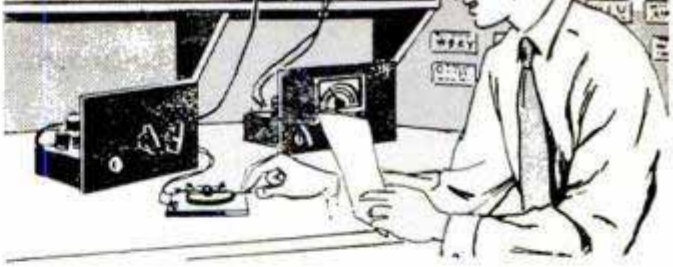
Care should be taken in wiring, especially when making connections to the small tube sockets. Mark the positions of the various tube terminals on the underside of the chassis, as even an experienced set builder can become confused very easily. When winding the coils following the chart, Fig. 3, be sure that the various coils are "poled" properly with the connections to the pins in the six-prong forms made exactly as shown in the diagrams. The same coil terminals match the coil socket in the chassis base, and the corresponding coil terminals are numbered in the schematic circuit diagram, Fig. 1. Cross check all diagrams to be sure that your wiring agrees.

The set operates from a large 1½-volt A-battery and one 45-volt B-battery. A flashlight bulb (size not important) should be connected in series with the positive-B 45-volt lead to serve as a fuse. This protects the tubes from burnouts in case the B-voltage is accidentally applied to the tube filaments. With the batteries connected, and tubes and coil in, plug in the headphones. There should be a loud "click." If nothing is heard, recheck the battery connections and the circuit wiring. Connect the antenna and external ground wires, and if everything is working correctly you will hear a whistle as the set is tuned through a station. Backing off, or turning back, the regeneration control R4 should clear up the whistle and bring in the station clearly. For the local stations, an indoor antenna and a ground connection are all that is required. For greater distance use an outdoor antenna. With a battery-operated emergency receiver of this description, you are not cut off from outside news and vital civil-defense information should local power sources fail. Most of us do not realize just how important this could be. The No. 1 set is quite simple and all parts are easily available. Detailed student material list R-400 for this May 1951 battery-operated No. 1 progressive set is available from Popular Mechanics Radio and Electronics department upon receipt of ordinary letter postage.

A Low-Cost CW Transmitter For the New Novice Ham Band

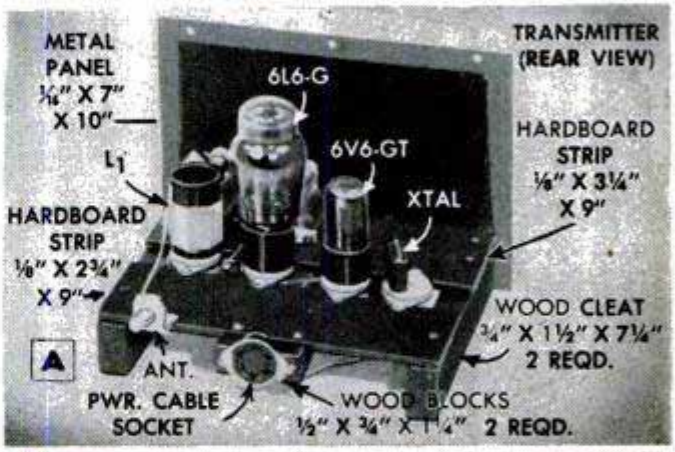
By S. A. Johnson WØLBV

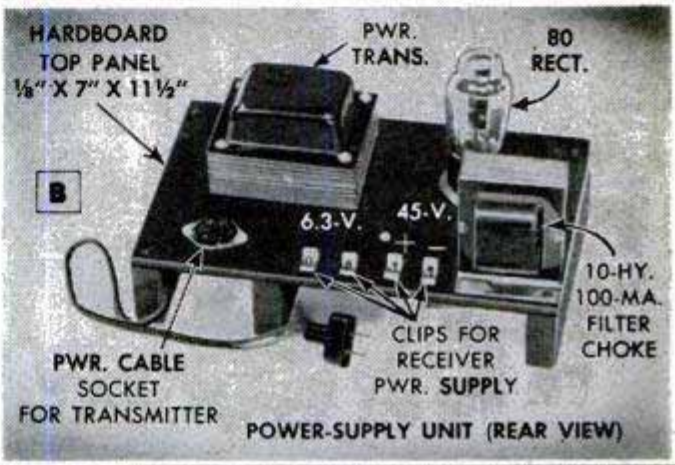
PART I



WHEN the newcomer in ham radio has passed his novice examination and received his operating ticket, the next step is to build a simple transmitter that will operate in the 3700 to 3750 kilocycle (80-meter) CW novice band recently set aside for beginners. Like the novice-band receiver described in the September issue, the transmitter is built up on hardboard bases supported with wooden cleats in order to simplify construction and keep down cost. The transmitter-unit base is divided into two panels spaced the width of the tube sockets so that all sockets may be mounted without the necessity for drilling large mounting holes.

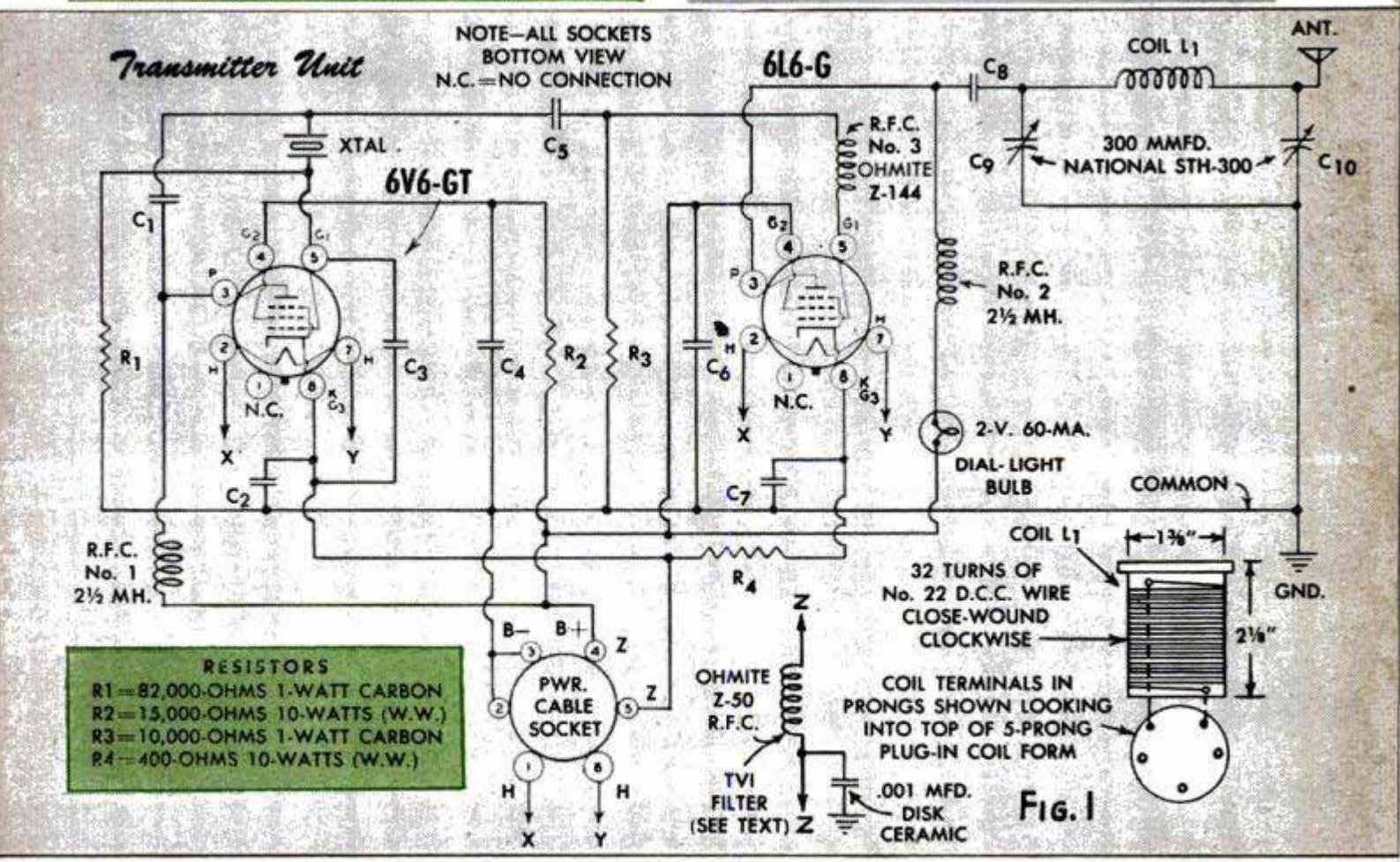
On the underside of the transmitter unit,





FIXED CONDENSERS FOR TRANSMITTER UNIT

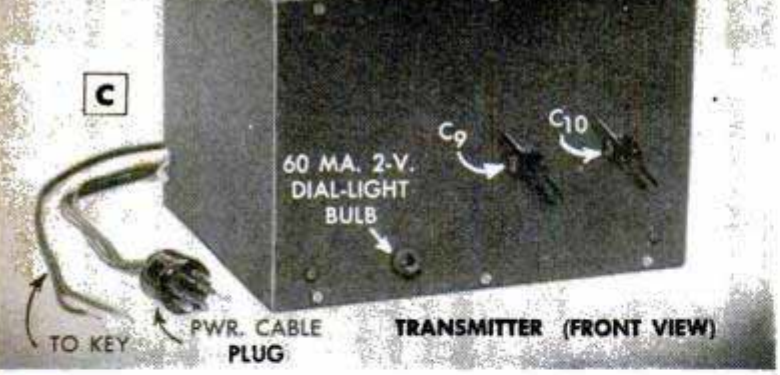
C1=.001 mfd. 500-V. mica type
C2=.001 mfd. 500-V. disk-ceramic type
C3=.0001 mfd. 500-V. mica type
C4=.01 mfd. 500-V. disk-ceramic type
C5=.0001 mfd. 500-V. mica type
C6=.01 mfd. 500-V. disk-ceramic type
C7=.01 mfd. 500-V. disk-ceramic type
C8=.001 mfd. 500-V. mica type

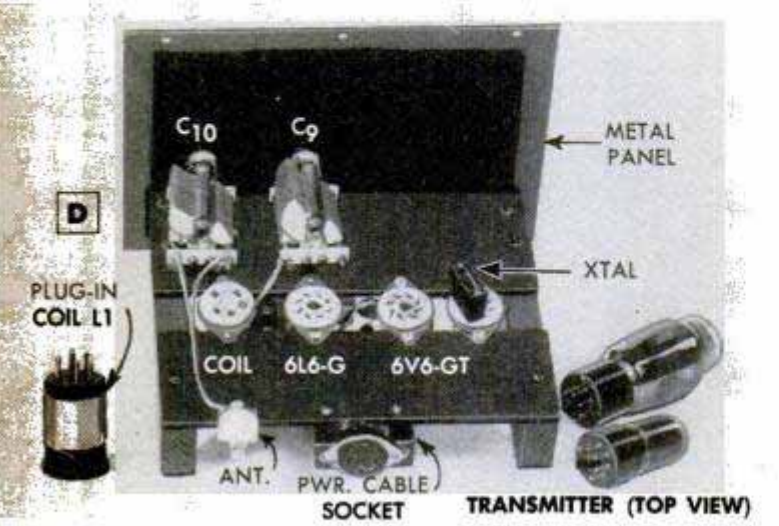


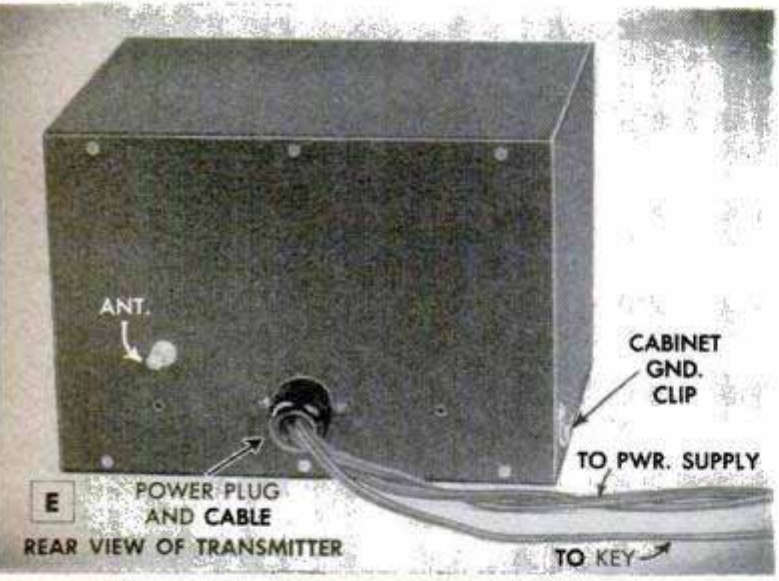
RESISTORS

R1=82,000-OHMS 1-WATT CARBON
R2=15,000-OHMS 10-WATTS (W.W.)
R3=10,000-OHMS 1-WATT CARBON
R4=400-OHMS 10-WATTS (W.W.)

FIG. 1







the cleats are notched at front so that this unit can be fitted into a standard-size metal cabinet if this is necessary in order to reduce interference with a near-by television receiver. Actually, because the power is low, and the frequency of operation is also low, the metal cabinet is seldom required. The transmitter is crystal-controlled and uses a 6V6-GT or 6V6 oscillator tube, although a 6F6 can be substituted without circuit changes. The oscillator is followed by a 6L6-G (or 6L6) amplifier tube. This amplifier includes a "pi" network which makes it easy to couple the transmitter to the antenna.

The power for the transmitter is obtained from the separate power-supply unit and is fed in through a 6-prong socket and plug-in cable arrangement. The socket shown on the rear of the chassis in photo A is mounted on two small pieces of wood. This places the socket in position to fit a hole cut in the rear of the cabinet, if one is used.

In wiring the transmitter, the first step is to provide a common-ground strip, or bus bar, of 14-gauge bare copper wire. This is run between two dead pins on the coil socket for L1 and crystal socket respectively. Photos A, C, D and F show various views of the transmitter; photos C and E show it housed in a cabinet. The schematic circuit diagram for the transmitter appears in Fig. 1, and the diagram for the power-supply unit is given in Fig. 2. Photos B and G show top and bottom views of the power unit.

The crystal selected for the transmitter should have some frequency between 3700 and 3750 kilocycles. It is a good idea to buy a crystal which is well within the band. To make an expensive meter unnecessary, a 60 ma., 2-volt dial-light bulb is connected in series with the B-plus lead to the amplifier stage of the transmitter. The bulb

(Continued to page 236)

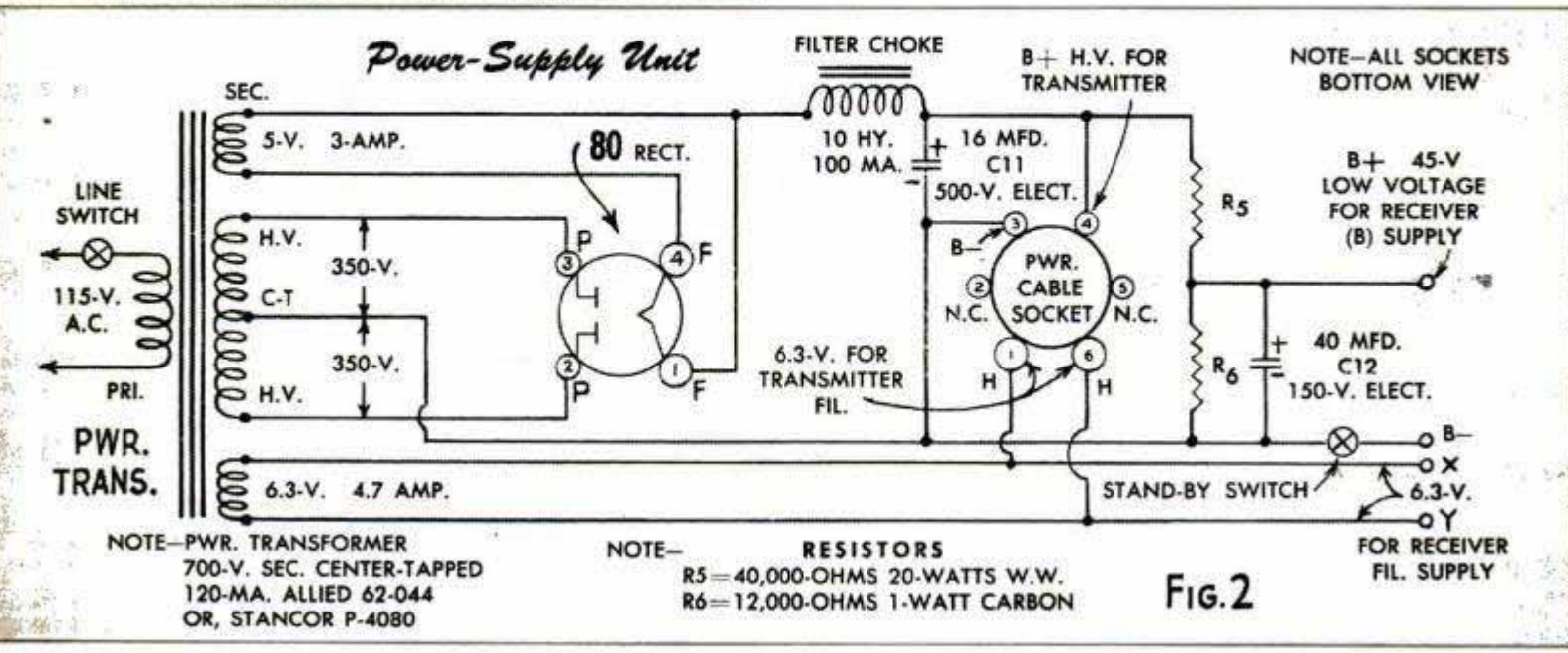


FIG. 2

Care and Feeding of Engines

BY S. P. CORP

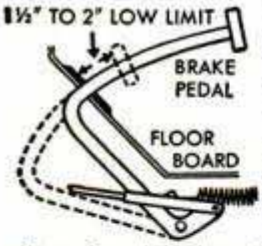
WHEN BRAKES DON'T BRAKE

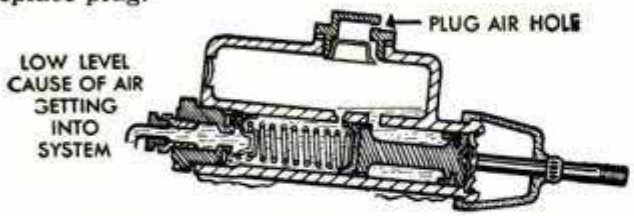
You're rolling merrily along. There's a stop sign ahead, for a main highway. You put your foot on the brakes. Nothing happens. For a few sickening seconds you go along with your heart in your mouth. You pray there isn't a car coming. There isn't. But there might just as well have been.

To keep this from happening, check your brakes often. Watch the position of the brake pedal when you stop quickly. If the underside of the pedal is less than 1½ to 2 inches from the floor, your brakes need adjusting. If you have to "pump brakes" to stop, your brakes need adjusting. Adjust the shoe of each brake.

AIR IN SYSTEM

Even after brakes are adjusted, you may have stopping trouble. If the pedal feels spongy or soft as you step on it, you probably have air in the hydraulic system. Check for air in the system by applying the brake with the car stopped. Hold the pedal down for a few seconds, then apply a little more pressure. If it moves down again, or feels spongy, you have air in the system, which must be removed by a bleeding operation at any good service station. Air gets in when brake fluid gets too low in the master cylinder. Check this level often, by cleaning top of cylinder and removing plug. If fluid is lower than ½ inch below top of cylinder, add fluid. See that air hole in plug is clean, then replace plug.





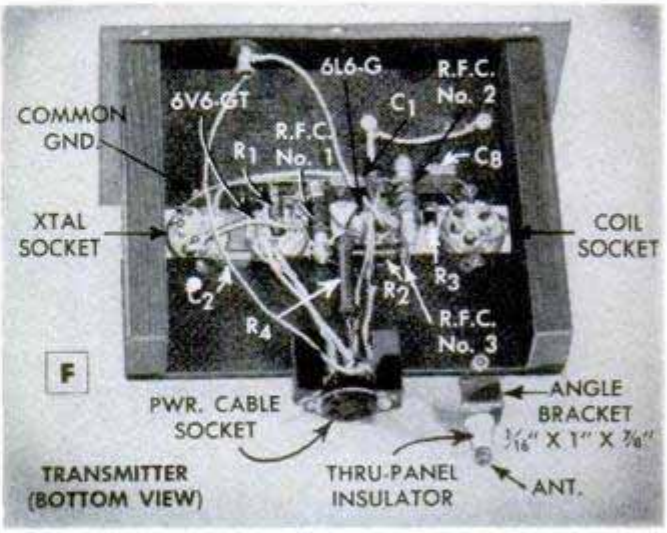
IF YOUR CAR SMOKES TOO MUCH

A smoking exhaust means your engine is wasting gas and oil, and needs new Sealed Power Piston Rings. The Sealed Power MD-50 is the best steel oil ring ever made. It controls oil even in badly tapered and out-of-round bores. Your dealer has Sealed Power Rings or can get them for you. A postal to Sealed Power, Dept. G-10, Muskegon, Mich., will bring you free helpful book, "7 Ways to Save Oil."

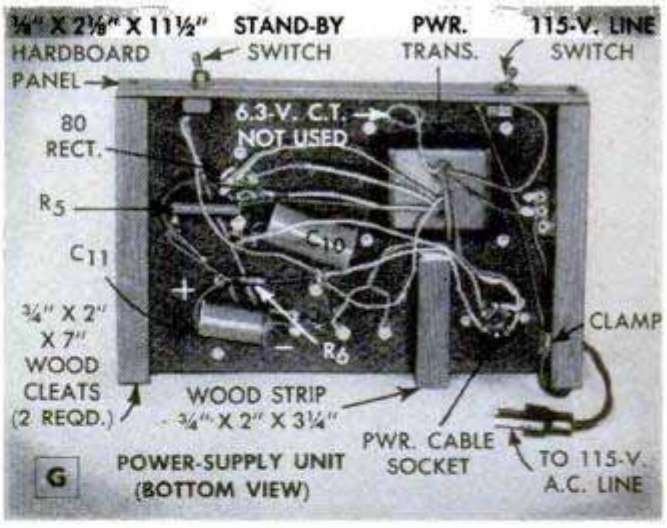
Low-Cost CW Transmitter

(Continued from page 232)

glows as the amplifier stage is coupled to the antenna for final tuning. The transmitter key is of standard type mounted on a small base. It connects to the separate pair of cable leads in the 6-prong plug that goes



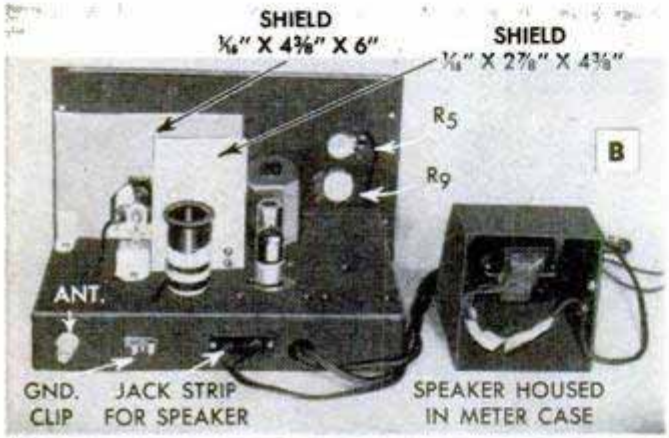
in the 6-prong power-cable socket in the rear of the transmitter chassis. This separate pair of key leads connects to socket terminals 2 and 5 in this transmitter power-cable socket. The other two pairs of leads in the cable supply the heater and B-voltage to the transmitter. These cable leads may be ordinary rubber-covered 2-conductor lamp cord, all about 3 ft. long. If the



TV filter shown in Fig. 1 is required, it should be connected right at the power-plug socket at the points indicated by the letter Z in diagram Fig. 1.

Antenna-construction details, and tuning instructions for putting this novice-band station on the air, will appear in a concluding article in the November issue. Detailed student material list R-404 for this CW transmitter is available from Popular Mechanics Radio and Electronics department upon receipt of ordinary letter postage.

BATTERY-OPERATED FIVE-BAND RECEIVER



THIS MULTIBAND battery-operated receiver is set No. 2 in the progressive series for experimenters that began in the May 1951 issue. Practically all of the same parts can be employed, with additions. This final No. 2 receiver is a complete unit in every detail. Therefore, it is not necessary to build the first set unless you wish to do so as a student project.

Battery-operated radio receivers are in demand today. The main reason, of course, is the fact that battery sets are independent of power lines, a necessary factor stressed by those planning civil-defense programs. This receiver is especially designed for advancing experimenters and purposely employs hand-wound plug-in coils for this reason. Plug-in coils are highly efficient in short-wave receivers, and they are not difficult to wind. This is an excellent DX short-wave student set and can be used almost anywhere as the 1½-volt A-battery and 90-volt B-batteries are self-contained.

If you built the May 1951 two-tube set, R-400 in this series, remove all previous wiring and drill the new holes required for mounting the additional tubes and parts. Complete chassis-base and front-panel details are shown in Fig. 3. Note that the small variable condensers C11 and C12 shown in circuit diagram, Fig. 2, serve for

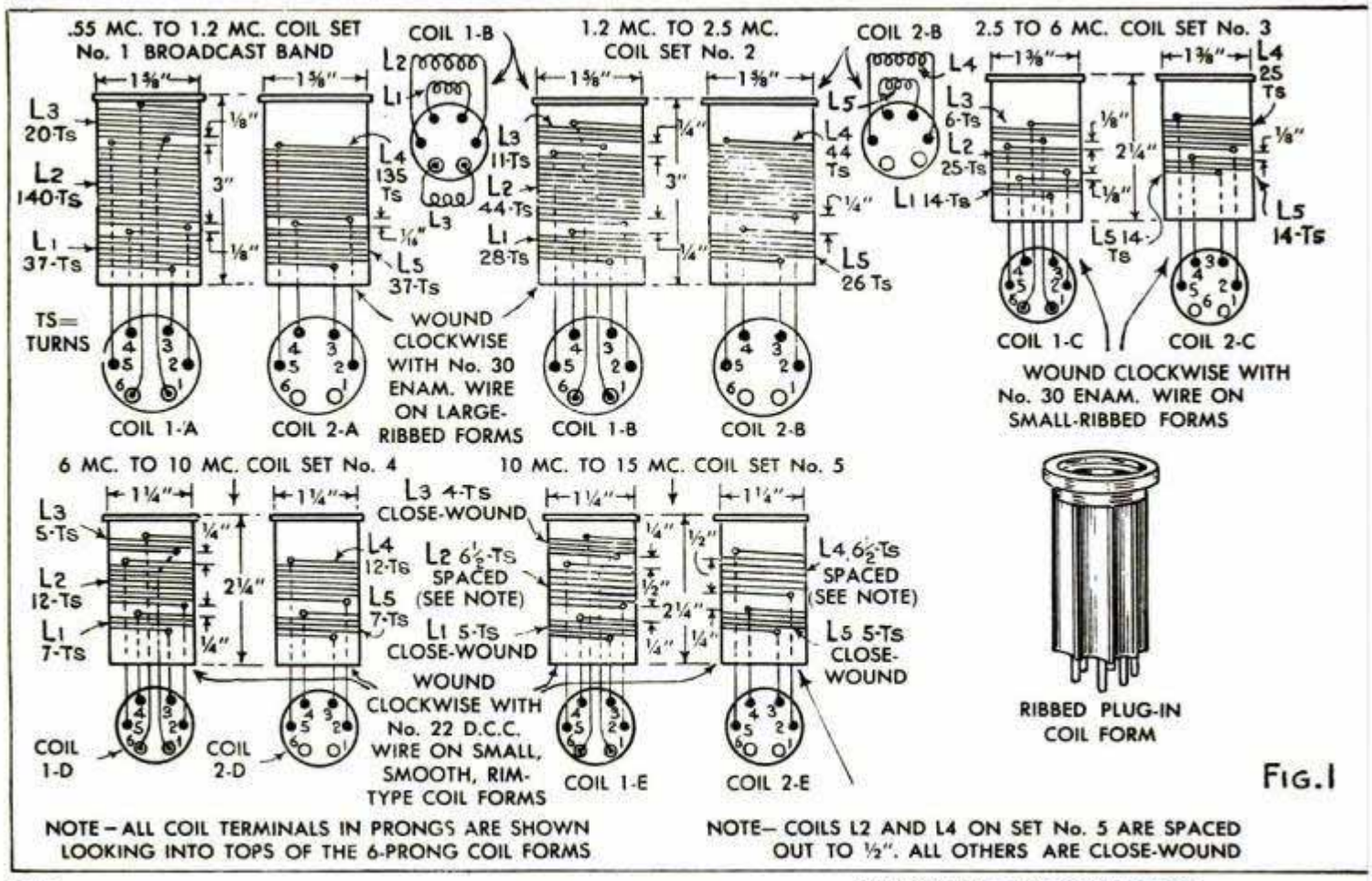
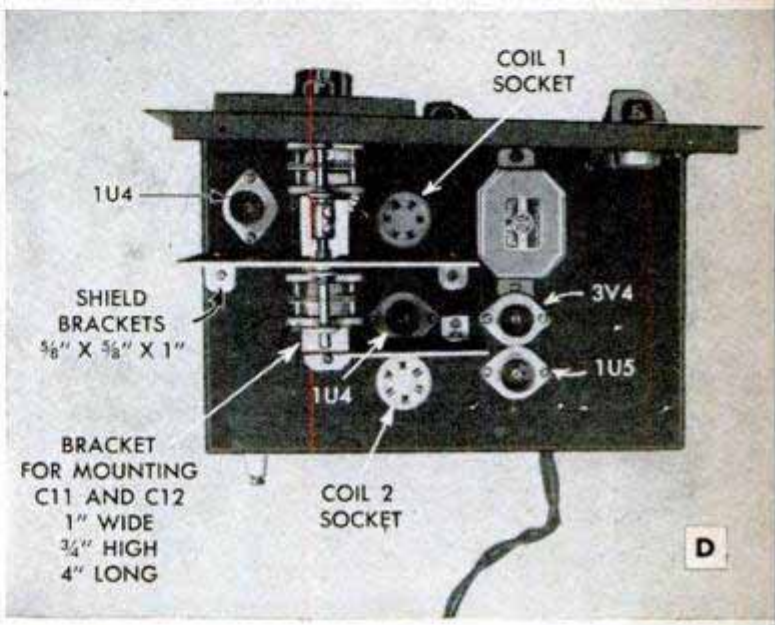


FIG. 1

FOR EXPERIMENTERS

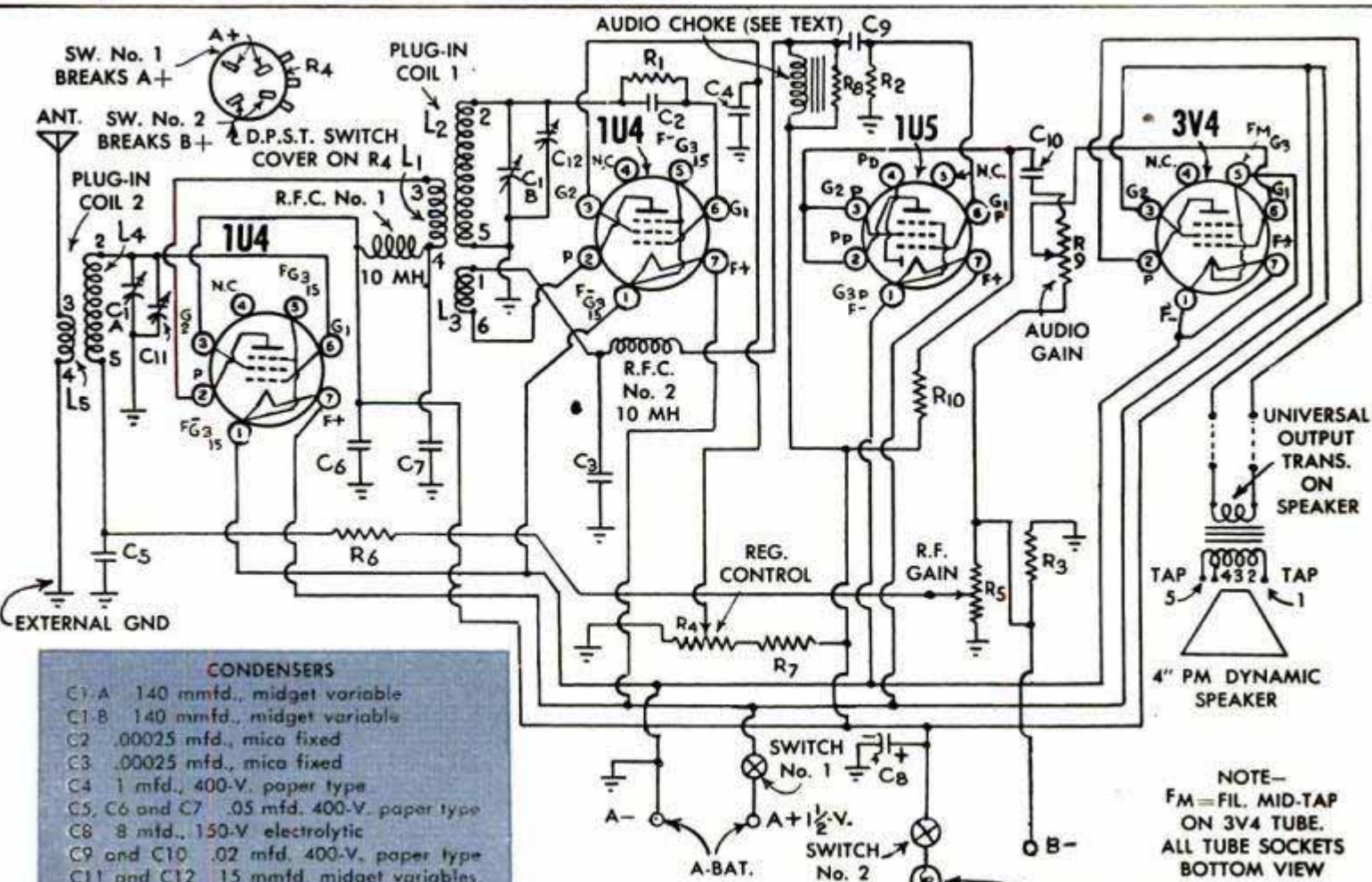
bandspread tuning. Photos D, G and H show these condensers mounted on a small metal strip on top of the chassis base. This bracket strip, indicated in photo D, raises them clear of the chassis and places them in the proper position. The bandspread dial is a vernier type, which simplifies tuning on the short-wave bands. Wiring is not difficult but should be done very carefully, keeping all leads as short as possible. The audio choke is the same as the one used in the first set; it can be any 500-hy. type such as the UTC S-23 or a similar unit. Any standard 3 to 1 ratio audio transformer can be substituted by connecting the primary and secondary windings in series.

All of the plug-in coils are clearly detailed in Fig. 1; they cover all bands from .55 megacycles to 15 megacycles, thus including the standard broadcast band and



RESISTORS

R1 = 2-megohm, ½-watt carbon
R2 = .5-megohm, ½-watt carbon
R3 = 470-ohm, ½-watt carbon
R4 = 50,000-ohm volume control, linear taper, with D.P.S.T. switch cover
R5 = 50,000-ohm, R.F. gain control, linear taper
R6 = 100,000-ohm, ½-watt carbon
R7 = 30,000-ohm, ½-watt carbon
R8 = 250,000-ohm, ½-watt carbon
R9 = 500,000-ohm, volume control, audio taper
R10 = .5 megohm, ½-watt carbon



CONDENSERS

C1-A 140 mmfd., midget variable
C1-B 140 mmfd., midget variable
C2 .00025 mfd., mica fixed
C3 .00025 mfd., mica fixed
C4 1 mfd., 400-V. paper type
C5, C6 and C7 .05 mfd. 400-V. paper type
C8 8 mfd., 150-V. electrolytic
C9 and C10 .02 mfd. 400-V. paper type
C11 and C12 .15 mmfd. midget variables

NOTE—
FM = FIL. MID-TAP ON 3V4 TUBE.
ALL TUBE SOCKETS BOTTOM VIEW

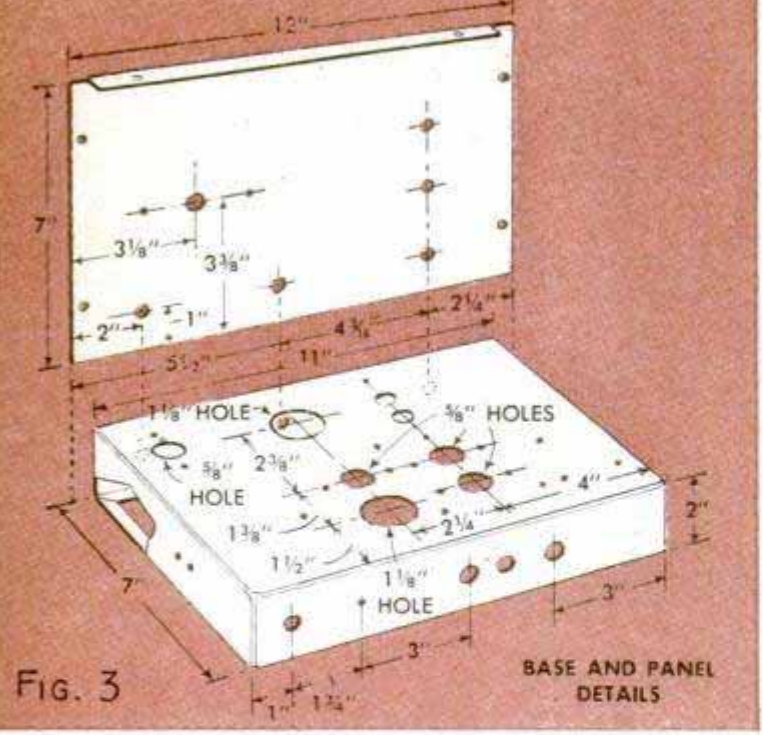
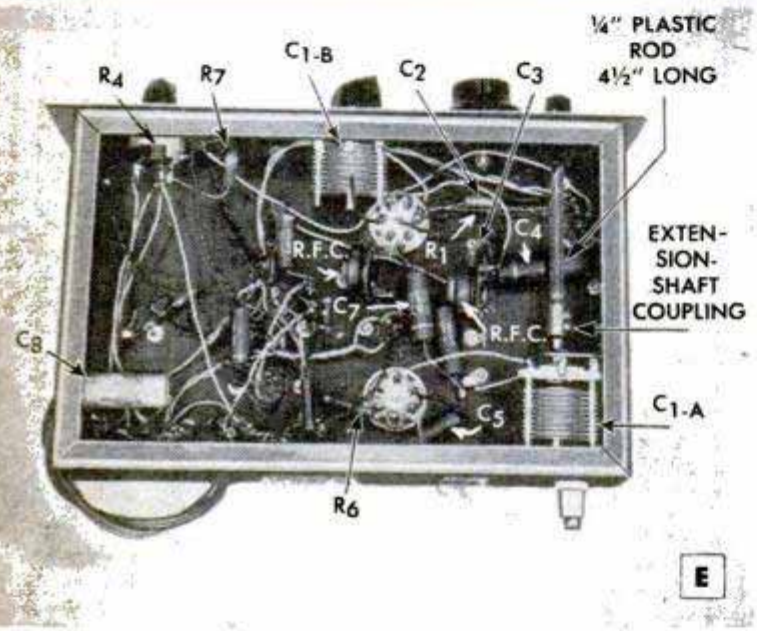
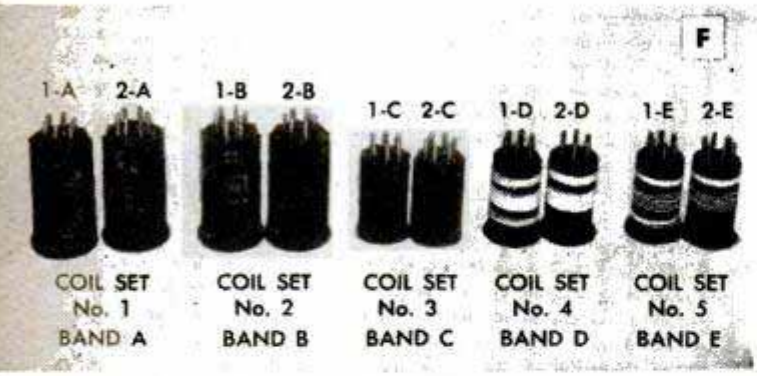


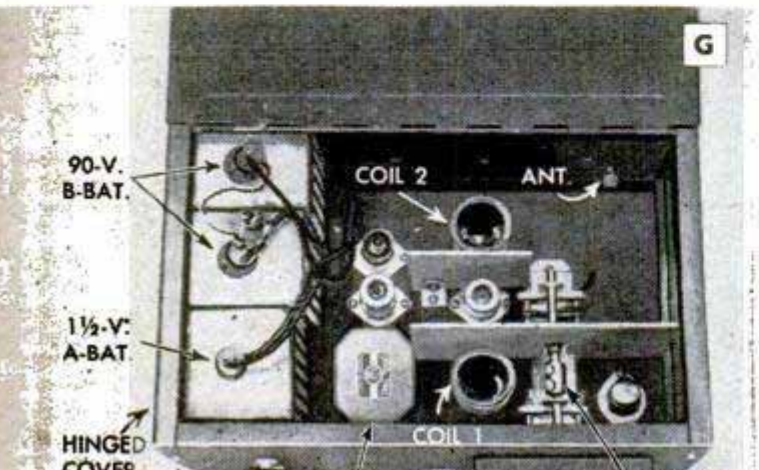
FIG. 3

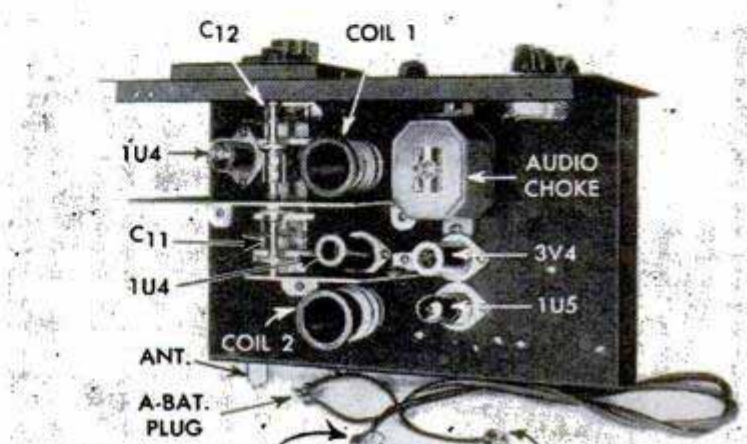
the important short-wave bands. There are 10 plug-in coils, and two of them are used for each band covered. Each pair is made up in the same way although different sizes of coil forms and windings are employed. The completed receiver fits into a standard hinged-lid metal cabinet which is available from all large radio-parts houses. All parts specified are standard and easily obtained. Having the small speaker as a separate unit eliminates microphonic troubles, and also makes it possible to plug in headphones. The speaker and its output transformer can be mounted in any small wood or metal case. In order to keep the coil winding simple, no effort was made to gang the tuning of the larger variable condensers C1-A and C1-B. Therefore, on the broadcast band, stations should be selected by rotating C1-B and then peaking the station up with C1-A, the R.F. peaking control indicated in photos A and E. The regeneration control is advanced far enough to hear the whistle as the station is tuned in, then is backed off until the signal is clear. The other two controls are audio and R.F. gain. Be sure to use the shields indicated in photo B, and also use tube shields on tubes 1U4 and 3V4 as shown in the top-view photos G and H.

Tuning on the short-wave bands is easy. Set the bandsetting condenser to about the center of the band that is to be covered, and turn peaking control knob for maximum signal. Then do all fine tuning with the main tuning dial. Once the band has been set, only a slight adjustment of the regeneration control is required. The R.F. gain control is useful if you have strong stations near by. It can be backed off to prevent overloading. Use a short indoor antenna for local broadcast-band reception, then shift to a high outdoor antenna for short wave. The use of the external ground will depend upon local conditions. It will increase sensitivity but will reduce selectivity in the broadcast band. The ground clip is mounted directly on the chassis base at rear. Detailed student material list R-405 is available from Popular Mechanics Radio and Electronics department upon receipt of ordinary letter postage.









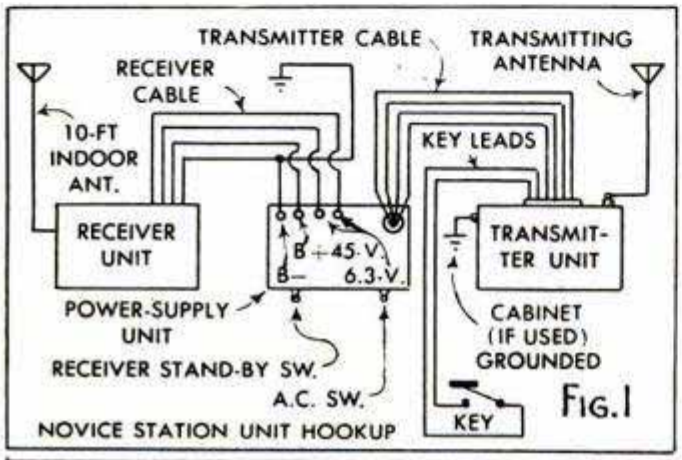
HOW TO PUT YOUR NOVICE-BAND STATION ON THE AIR

By S. A. Johnson WØLBV

Part II

NOW THAT the proud holder of a license to operate in the new novice ham band has completed the transmitter R-404 described in the October 1951 issue of this magazine, he is ready to assemble his amateur radio station. A suitable receiver for this new novice ham band appeared in the September 1951 issue. These combine to form a complete novice-band ham station.

When the complete station is assembled, the power supply for the receiver is obtained from the transmitter power-supply unit; a stand-by switch on the power unit cuts the negative-B supply to the receiver to silence it while the operator is transmitting. The station assembly is shown in Fig. 1. The operating table should be placed near a window so that it will be easy to connect to the transmitting antenna. The receiving antenna can be a short (10 or 15-ft.) length of insulated hookup wire attached to the wall of the room with cellulose tape. The receiver referred to is R-403.



NOVICE STATION UNIT HOOKUP FIG. 1

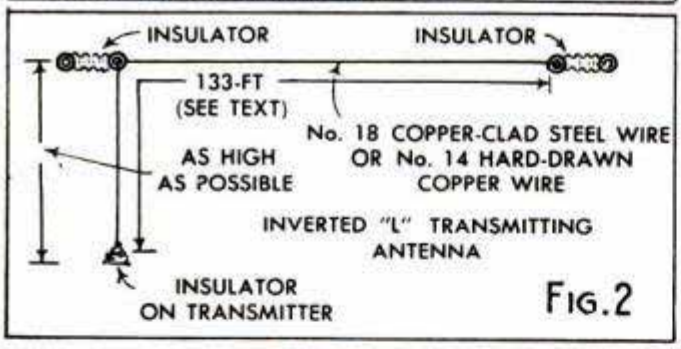


FIG. 2

An ideal transmitting antenna for this particular transmitter is the one detailed in Fig. 2. If this is not possible on account of space, the wire can be as short as 66 ft. For best results a good ground is highly important. It can be made on a cold-water pipe, or by driving a row of 6-ft. rods along the shaded side of the house and then connecting them all together. The antenna wire should be No. 18 copper-clad steel wire, or No. 14 hard-drawn copper. Bring the lead-in through a porcelain or polystyrene tube inserted in a hole drilled through a board placed under the window sash. Now with the power unit, transmitter and key connected, and the receiver cut off with the stand-by switch, you are ready to tune the transmitter. Turn the right-hand control on the transmitter to maximum capacity—then rotate the left-hand control. The dial light on the transmitter will go out at some point in the dial range. Next, open up the right-hand condenser a small amount at a time — each time "redipping" with the left-hand control. As you slowly open up the right-hand condenser and retune with the left, the transmitter begins to "load up." Eventually a setting will be found at which the bulb only flickers ever so slightly as you tune through resonance with the left-hand condenser. At this point, loading should be sufficient. Now, if the transmitter follows the key as indicated by the panel light, you are on the air and ready to call your first station.